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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/628,323	07/28/2003	Niels Johannes Beck	1125.131	4443
23598	7590	05/28/2004	EXAMINER	
BOYLE FREDRICKSON NEWHOLM STEIN & GRATZ, S.C.			TRIEU, THAI BA	
250 E. WISCONSIN AVENUE			ART UNIT	PAPER NUMBER
SUITE 1030			3748	
MILWAUKEE, WI 53202			DATE MAILED: 05/28/2004	

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	10/628,323	BECK ET AL. <i>CBQ</i>
	Examiner	Art Unit
	Thai-Ba Trieu	3748

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) Responsive to communication(s) filed on _____.
- 2a) This action is **FINAL**. 2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) Claim(s) 1-38 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) Claim(s) 21-28 is/are allowed.
- 6) Claim(s) 1-4,9-13,29,30,32,34 and 38 is/are rejected.
- 7) Claim(s) 5-8,14-20,31,33 and 35-37 is/are objected to.
- 8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on _____ is/are: a) accepted or b) objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) All b) Some * c) None of:
 1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)	4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)	5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)
3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date <u>07/28/2003</u> .	6) <input type="checkbox"/> Other: _____.

DETAILED ACTION

The numbering of claims is not in accordance with 37 CFR 1.126 which requires the original numbering of the claims to be preserved throughout the prosecution. When claims are canceled, the remaining claims must not be renumbered. When new claims are presented, they must be numbered consecutively beginning with the number next following the highest numbered claims previously presented (whether entered or not).

Since applicants omitted claims 9 and 13, the examiner, pursuant to rule 1.126, has renumbered claims 10-40 as claims 9-38. The rejections set forth below are based on the renumbered claims.

Drawings

The drawings are objected to because of the following minor informalities:

- The elements “20”, “42”, and “54” should be replaced by -- 420 --, -- 442 --, -- 454 -- (See Figure 17).

A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

The disclosure is objected to because of the following informalities:

- On Page 7, line 6, “**Fig. 5 corresponds to Fig 5...**” should be replaced by -- **Fig. 5 corresponds to Fig 4....** (for correcting typo error).

- On Page 9, line 9, “*Di is the injection delay period...*” should be replaced by -- *Di is the ignition delay period ...*-- (for correcting typo error).
- On Page 13, line 10, “*turbo bypass 76*” should be replaced by – *turbo bypass valve*-- (for consistency of the whole specification).
- On Page 14, lines 8-9, “*chamber 304*” should be replaced by – *toroidal chamber 304* -- (for consistency of the whole specification).
- On Page 20, line 22, “*piston 14*” should be replaced by -- *piston 16*--; and line 23, “*cylinder head 16*” should be replaced by -- *cylinder head 14* -- (for correcting typo error).

Appropriate correction is required.

Claim Objections

Claims 6-7, 9, 13, 15, 17-20, 22-28, and 30-37 are objected to because of the following informalities:

- In claims 6-7, and 9, --*said*-- should be inserted before “*ACT*”, “*MAP*”, “*Ti*” (*for avoiding double citation in claims*).
- In claim 13, 17-20, 22-28, and 30-37, line 1 should be replaced by following:
 - [[15.]] 13. The method as recited in claim [[14]] 12;
 - [[17.]] 15. The method as recited in claim [[16]] 14;
 - [[19.]] 17. The method as recited in claim [[18]] 16;
 - [[20.]] 18. The method as recited in claim [[19]] 17;
 - [[21.]] 19. The method as recited in claim [[19]] 17;

- [[22.]] 20. The method as recited in claim [[19]] 17;
- [[24.]] 22. The method as recited in claim [[23]] 21;
- [[25.]] 23. The method as recited in claim [[14]] 21;
- [[26.]] 24. The method as recited in claim [[14]] 21;
- [[27.]] 25. The method as recited in claim [[14]] 24;
- [[28.]] 26. The method as recited in claim [[14]] 21;
- [[29.]] 27. The method as recited in claim [[14]] 26;
- [[30.]] 28. The method as recited in claim [[14]] 26;
- [[32.]] 30. The method as recited in claim [[14]] 29;
- [[33.]] 31. The method as recited in claim [[14]] 29;
- [[34.]] 32. The method as recited in claim [[14]] 29;
- [[35.]] 33. The method as recited in claim [[14]] 29;
- [[36.]] 34. The method as recited in claim [[14]] 32;
- [[37.]] 35. The method as recited in claim [[14]] 29;
- [[38.]] 36. The method as recited in claim [[14]] 35; and
- [[39.]] 37. The method as recited in claim [[14]] 35.

- In claim 21, line 3, -- **said** -- should be inserted before "**primary fuel**" (for *avoiding double recitation*).

Appropriate correction is required.

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

Claims **1-4 and 9-13** are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims **1, 3-6, and 12-15** of U.S. Patent No. **6,598,584 B2**. Although the conflicting claims are not identical, they are not patentably distinct from each other because claims **1, 3-6, and 12-15** of the patent "anticipate" application claims **1-4 and 9-13**. Accordingly, application claims **1-4 and 9-13** are not patentably distinct from patent claims **1, 3-6, and 12-15**. Patent claims **1, 3-6, and 12-15** require the following elements:

- injection a pilot fuel;
- controlling at least one of a timing T_p , of initiation of pilot fuel injection, a pilot fuel injection duration D_p , and an ignition delay period D_i , such that D_p/D_i is <1 ;
- controlling step comprising obtaining a mixing period, $D_m > 1^\circ \text{c.a.}$, where $D_m = D_i - D_p$;

- controlling step comprising obtaining a D_m between 5° c.a. and 40° c.a.;
- obtaining step comprising altering auto-ignition timing T_i ;
- T_i being altered by adjusting exhaust gas recirculation, EGR;
- adjusting at least one of T_p and D_p ;
- adjusting a rate of pilot fuel in the combustion chamber...;
- operating an electronically actuated fuel injector...; and
- injecting fuel in an expanding cloud....

While in the instant application, claims 1-4 and 9-13 require elements:

- injection a pilot fuel;
- controlling at least one of a timing T_p , of initiation of pilot fuel injection, a pilot fuel injection duration D_p , and an ignition delay period D_i , such that D_p/D_i is < 1 ;
- controlling step comprising obtaining a mixing period, $D_m > 1^\circ$ c.a.,

where $D_m = D_i - D_p$;

- controlling step comprising obtaining a D_m between 5° c.a. and 40° c.a.; and
- controlling step comprising altering auto-ignition timing T_i ;
- T_i being altered by adjusting exhaust gas recirculation, EGR;
- adjusting at least one of T_p and D_p ;
- adjusting a rate of pilot fuel in the combustion chamber...;
- operating an electronically actuated fuel injector...; and
- injecting fuel in an expanding cloud....

Since the application claims 1-4 and 9-13 are anticipated by Patent claims 1, 3-6, and 12-15 since the anticipation is the epitome of obviousness, then, application claims 1-4 and 9-13 are obvious over Patent claims 1, 3-6, and 12-15.

Claim 38 is rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claim 23 of U.S. Patent No. 6,598,584 B2. Although the conflicting claims are not identical, they are not patentably distinct from each other because claim 23 of the patent "anticipates" application claim 38. Accordingly, application claim 38 is not patentably distinct from patent claims 23. Patent claim 23 requires the following elements:

- performing an intake stroke of the piston;
- performing a compression stroke of the piston after the intake stroke;
- admitting a homogenous charge of a liquid fuel and air into the combustion chamber during one of the intake stroke and the compression stroke,
- injecting a pilot fuel charge into the combustion chamber during the compression stroke,
- combusting said pilot fuel charge to ignite the gaseous fuel,
 1. initiating pilot fuel injection at a time, T_p ,
 2. continuing pilot fuel injection for a duration, D_p , and
 3. igniting the pilot fuel charge by compression-ignition at an autoignition point, T_i , occurring an ignition delay interval D_i after T_p ; and

4. controlling at least one of T_p , D_p , and D_i to maintain $D_p/D_i < 1$.

While in the instant application, claim 38 requires elements:

- performing an intake stroke of the piston;
- performing a compression stroke of the piston after the intake stroke;
- admitting a homogenous charge of a liquid fuel and air into the combustion

chamber during one of the intake stroke and the compression stroke,

- injecting a pilot fuel charge into the combustion chamber during the compression stroke,

- combusting said pilot fuel charge to ignite the gaseous fuel,
 1. initiating pilot fuel injection at a time, T_p ,
 2. continuing pilot fuel injection for a duration, D_p , and
 3. igniting the pilot fuel charge by compression-ignition at an autoignition point, T_i , occurring an ignition delay interval D_i after T_p ; and
- 4. controlling at least one of T_p , D_p , and D_i to maintain $D_p/D_i < 1$.

Since the application claims 38 are anticipated by Patent claim 23, and since the anticipation is the epitome of obviousness, then, application claim 38 is obvious over Patent claim 23.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 29-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hiltner (Patent Number 6,463,907 B1), in view of Haldeman et al. (Patent Number 6,010,544).

Hiltner discloses a method comprising:

injecting a liquid fuel into an air stream to form a homogeneous mixture of air (See Column 2, lines 21-32);

admitting said mixture into a combustion chamber of an internal combustion engine (See Figures 1-3);

igniting the liquid fuel in said mixture by compression ignition so as to achieve homogeneous charge compression ignition (HCCI) of said liquid fuel (See Figures 1-3, Column 8, lines 1167, and Column 9, lines 1-4).

However, Hiltner fails to disclose atomized droplets of fuel having a diameter less than about 50 microns and between about 5 microns and about 20 microns.

Haldeman et al. teach that it is conventional in the combustion system art, to utilize an atomized droplets of fuel having a diameter less than about 50 microns and between about 5 microns and about 20 microns (See Abstract, and Column 1, lines 25-30).

It would has been obvious to one having ordinary skill in the art at that time the invention was made, to have utilized an atomized droplets of fuel having a diameter less than about 50 microns and between about 5 microns and about 20 microns, as taught

by Haldeman et al., to improve the efficiency of the Hiltner device, since the use thereof would have improved the microscopic homogeneity and reduced particulate matter production.

Claims 32 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hiltner (Patent Number 6,463,907 B1), in view of Haldeman et al. (Patent Number 6,010,544), and further in view of Talbert (Patent Number 4,429,675).

The modified Hiltner device discloses the invention as recited above; however, fails to disclose said liquid fuel being injected via at least one fogging nozzle and having an impaction device.

Talbert teaches that it is conventional in the fuel system of the internal combustion engine art, to utilize a fogging nozzle (via 99) to inject said liquid fuel and an impaction device to atomize fuel droplets(See Figure 1, Column 4, lines 59-68, and Column 5, lines 1-3).

It would has been obvious to one having ordinary skill in the art at that time the invention was made, to have utilized the fogging nozzle and an impaction device, as taught by Talbert, to provide fine fuel droplets and improve the efficiency of the modified Hiltner device.

Allowable Subject Matter

Claims 21-28 are allowed.

Claims **5-8, 147-20, 31, 33, and 35-37** are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is an examiner's statement of reasons for allowance: The prior art fails to disclose or render obvious the claimed combination for a method to form a homogeneous mixture in an internal combustion engine including:

"supplying a relative very larger volume of a liquid primary fuel to a combustion chamber;

injecting a relatively small volume of a pilot fuel into said combustion chamber, said pilot fuel having a lower auto ignition temperature than said primary fuel and having relatively narrow boiling point temperature range; and

auto igniting said pilot fuel by compression ignition and igniting said primary fuel through combustion of said pilot fuel."

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

The IDS (PTO-1449) filed on July 28, 2003 has been considered. An initialized copy is attached hereto.

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

- Ancimer et al. (US Patent Number 6,640,773 B2) disclose a method and apparatus for gaseous fuel introduction and controlling combustion in an internal combustion engine.

- Roberts, Jr. (US Patent Number 6,557,520 B2) discloses a multi-zones combustion chamber and method for combustion control in compression-ignited reciprocating engines.

- Gray (US Patent Number 6,550,430 B2) discloses a method operating a dual fuel internal.

- Parish (US Patent Number 6,604,695 B1) discloses a method and fuel injector for setting gaseous injector static flow rate with injector stroke.

- Dickey (Patent Number 5,832,880) discloses an apparatus and a method for controlling homogeneous charge compression ignition combustion in diesel engines.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thai-Ba Trieu whose telephone number is (703) 308-6450. The examiner can normally be reached on Monday - Thursday (6:30-5:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thomas E. Denion can be reached on (703) 308-2623. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR.

Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

TTB
May 27, 2004



Thai-Ba Trieu
Patent Examiner
Art Unit 3748